

An End-To-End Microfluidic Platform for Engineering Life Supporting Microbes in Space Exploration Missions, Phase I

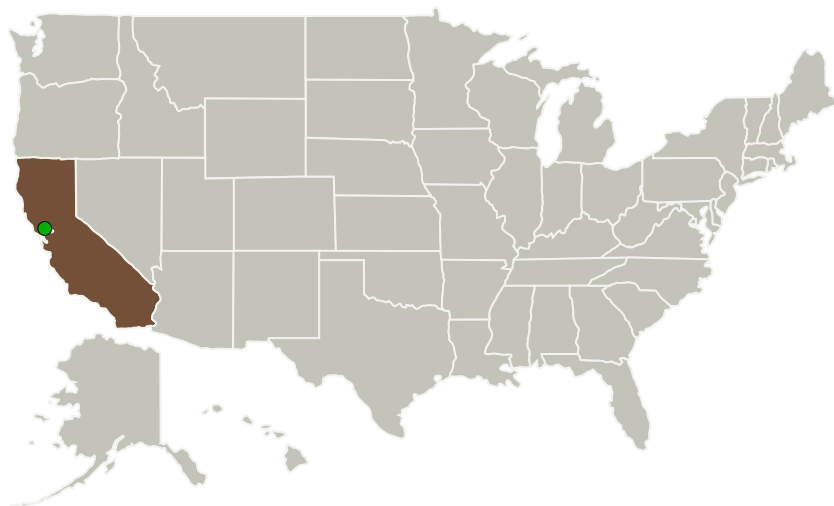
Completed Technology Project (2014 - 2014)



Project Introduction

HJ Science & Technology proposes a programmable, low-cost, and compact microfluidic platform capable of running automated end-to-end processes and optimization of cellular engineering and synthetic biology applications. In collaboration with Lawrence Berkeley National Laboratory and the Joint Genome Institute, we will establish the feasibility of the proposed microfluidic automation technology by engineering and screening cyanobacterial cells for enhanced production of free fatty acids (FFA), a metabolic crossroad for the synthesis of a suite of useful organic molecules including lipids, alkanes, and potential biofuels starting from carbon dioxide, a metabolic waste product. The ability to perform such automated synthetic biology experiments during NASA missions could enable the production of a broad range of materials on site, and optimization of bioregenerative systems in response to environmental changes. We will demonstrate the microfluidic automation capability for each of the key steps in cellular engineering: 1) construction of a plasmid containing genes for enhanced FFA production in cyanobacteria, 2) subsequent transformation into cyanobacterial cells/chromosomal integration, and 3) screening of expression products. As such, we can assess the FFA levels as a function of the gene variant in almost real time, thereby greatly enhancing our ability to control and optimize FFA production.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
HJ Science & Technology, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Berkeley, California
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Lawrence Berkeley National Laboratory(LBNL)	Supporting Organization	R&D Center	Berkeley, California

Primary U.S. Work Locations

California

Project Transitions

**June 2014:** Project Start**December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140635>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

HJ Science & Technology, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Erik Jensen

Co-Investigator:

Erik M Jensen

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Images

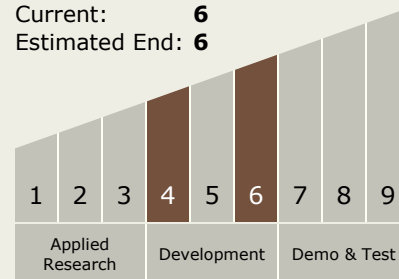


Briefing Chart

An End-To-End Microfluidic Platform for Engineering Life Supporting Microbes in Space Exploration Missions, Phase I
(<https://techport.nasa.gov/image/130121>)

Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - TX07.1 In-Situ Resource Utilization
 - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System